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THE PLACE OF FRUIT AND VEGETABLE CROPS IN FOOD PRODUCTION IN THE LESS DEVELOPED AREAS OF THE WORLD

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THE PLACE OF FRUIT AND VEGETABLE CROPS IN FOOD PRODUCTION IN THE LESS DEVELOPED AREAS OF THE WORLD

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1. The role of fruits and vegetables in supplying the nutrients that are today in short supply in the diets of developing nations is gaining recognition. The importance of fruits and vegetables does not lie in their contribution of carbohydrates or fats to the diet, but rather as providers of the vitamins, mineral salts and,in the case of legumes, the proteins that are indispensable for human health.

2. Paul C. Mangelsdorf of the Conservatory of Botany of Harvard University (1) and more recently John D. Rockefeller III, President of the Rockefeller Foundation, in his inaugural speech (2) at the 11th Session of the FAO Conference mentioned the important role played by certain plants in human nutrition. The number of known vegetable species exceeds 250,000 but man during the course of his history has used only 3,000 to feed himself. This number has become progressively reduced during the course of the centuries because the agronomist and the breeder have concentrated their efforts only on the most interesting ones. At present only 300 food plants are cultivated at a commercial level. Of these, twelve species alone produce 90 percent of the available world food supply. These species are rice, wheat, maize, sugar cane, sugar beet, potato, sweet potato, manioc, common bean, soya bean, coconut, and banana.

3. In this list the predominance of plants providing many carbohydrates (starch and sugars) is noticeable. Rice, for example, can be considered the most important food. Sixty percent of the inhabitants of the world obtain 80 percent of their daily

(1) Mangelsdorf, P.C., Biology, Food and People, Economic Botany 15-4, 279-288 Cambridge (Mass.) (1961)

(2) Rockefeller, John D., People, Food and the Well Being of Mankind, FAO, Rome (1961)

intake of calories from this crop. It is estimated that more than 30% of human energy in the world today is obtained from this one plant.

4. Undernourishment and malnutrition together affect one-third to one-half of the peoples of the world, the majority of whom live in the tropical and sub-tropical areas. The Nutrition Committee for South East Asia has pointed out that to combat the deficiency of proteins, vitamins and minerals in many rice eating countries, it will be necessary to step up the production and consumption of fruit, vegetables, and grain legumes. In a recent FAO study it was estimated that the population of the region will increase by 50% over the next 20 years and the production of fruit, vegetables, and grain legumes will need to be almost trebled by 1980 if reasonable nutritional requirements are to be met.

5. Typical diets in the tropics and in most low income nations, particularly in the highly populated regions are predominantly starchy in composition. Production of such crops as cassava, yams, cocoyams, plantains, rice, and maize, usually requires less land and less labour per 1000 calories than other foods. These crops, when eaten, fill the stomach but are very deficient in ~~protein~~, fats, minerals and proteins that are essential for good nutrition and good health.

6. Fruits and vegetables are good sources of vitamins and minerals, and legumes and nuts also supply proteins. Many nuts, for example, have a high oil and protein content, making them valuable human and animal foods. Vegetables belonging to the legume family such as beans and peas, are rich in proteins as well as carbohydrates. Fruits such as the avocado and olive are rich in oil. It will be evident that fruits and vegetables play a significant and often essential role in human nutrition and all methods should be used to encourage their further cultivation and consumption.

(a) PLACE OF FRUIT AND VEGETABLES IN THE CROPPING SYSTEMS

(i) Vegetables

7. An evaluation of the importance of vegetables in the tropical diets is difficult to make since statistics in most developing countries are notoriously inaccurate and year to year variations in the crops are large. It is therefore not possible to obtain figures for the amount used for home consumption from data on local and international trade.

8. Vegetable production in developing countries should increase substantially in the near future if standards of nutrition are to be improved and the increase in demand resulting from the rising tide of population and higher monetary incomes is to be met. The increase in production must be selective and directed especially towards horticultural products that provide nutrients now in short supply such as protein and vitamin A.

9. In many of the less developed countries, monoculture and shifting cultivation are frequent pradtices and they are among the main factors responsible for the lack of a satisfactory standard of agriculture. The introduction of vegetable crops into the cropping system would be advantageous for soil conservation, maintenance of soil fertility particularly through the introduction of legumes in the rotation. Such steps should lead to a more stable economy and a higher standard of living. Some tropical countries offer good examples of intensive multicropping systems.

10. In Taiwan, for example, rice or sugar cane are planted in rotation with vegetables. Many kinds of vegetables are cultivated as cash crops: carrots, cauliflower, spinach, lettuce, etc. in the cold season, while in the summer season egg plant, pepper, okra, cucumber, melon, etc., are commonly planted in the rice fields. In Central Taiwan, rice is grown continuously in the same field but either a green manure crop (such as Sesbania) or a summer vegetable such as melon is grown between the 1st and 2nd crop of rice. With the vegetable crop grown during the winter season, four crops are obtained per annum in this area. In non-irrigated districts a yearly single crop of rice is grown during the rainy season and followed by sweet potato, peanut, vegetables or green manure.

11. In Sierra Leone most of the vegetable cultivation takes place in the dry season along the sides of the streams. At this time of the year, streams can be channeled and diverted to provide irrigation water for vegetable crops such as: beans, lettuce, radish, kale, tomato, egg plant, shallot, etc. During the wet season the streams become small rivers and the dry season gardens are virtually abandoned after the final harvesting of the crops in May or June. The "wet season gardens" are then reconstituted on terraces sited on the upland, preferably below or near the dwelling houses. The range of crops grown during the rainy season, from May to October, is much less than that of the dry season.

12. In many tropical countries it should be possible to adapt such practices to local conditions in order to introduce vegetables crops into the short-term rotation systems. The development of school and community gardens, and home gardens in the compound or in the back yards, should be encouraged to teach new methods of food production and use in order to increase the yield and local consumption of more and better vegetables.

(ii) Fruits

13. There appear to be two main ways in which tree food crops may be fitted into cropping systems either - i) for subsistance or ii) on a plantation scale for cash. From a nutritional viewpoint both methods have their place. In both, the application of more advanced horticultural techniques, better varieties, fertilizers, irrigation, and pest and disease control will bring increases in quantity and quality of the crops. In the less developed countries large scale cultivation of fruit trees is not common for these are generally treated as "back yard" crops, being planted near and around the houses. It would be difficult to talk of orchard management since fruit trees are not planted in orchards, with a few exceptions such as bananas, pineapples, citrus, when grown for export.

14. In the humid tropics the growing of fruit tree crops on a modern intensive scale may encounter certain difficulties. In many cases where soils are exposed and cleared of their native vegetation, a general deterioration in fertility ensues depending on rainfall, soil type, and nature and duration of the cropping. Methods of preserving fertility are not so well established for tropical soils as for those in Northern latitudes, at least for some of the tropical crops that are being grown commercially on an increasing scale. This increase means a fundamental change in the traditional methods of so many developing countries, from shifting cultivation to permanent cropping. Apart from the technical aspects of cultivation of such soils, this change-over is often hindered by the system of land tenure for the land is often held communally and therefore offers little incentive to the individual farmer to improve it. Again, the small size and fragmented nature of the family holding may prevent any efficient mechanisation of cultivation, control of pests and diseases, etc. When these factors are overcome the uprooting of the dense vegetation is often a very costly and difficult task. However, that this is

possible is illustrated by the successful plantations of economic crops, i.e. cocoa and coffee.

15. In the more arid areas increase of production of plantation crops is primarily dependent on suitable water sources. While there has been tremendous development in irrigation schemes in many countries in the last decades, still much remains to be done. On the other hand, irrigation introduces the possibility of salt accumulation and waterlogging, and skill and experience is required by farmers before irrigation can be utilised successfully. Fortunately, plants show a marked difference in tolerance to salinity. Of the fruit crops the date palm is most resistant, pomegranates, figs, olives and grapes form an intermediate group, while citrus and avocado are very susceptible. However, when handled judiciously, irrigation is probably the largest single factor that will influence food production in vast areas of the world. It has been found in Israel, for example, that the introduction of water can reduce the land required by a farmer and his family by a factor of 10.

(b) NUTRITIONAL OBJECTIVES FOR HORTICULTURE IN THE TROPICS

16. The primary aim of agriculture should be to produce enough food to satisfy not only quantitative requirements, or calories, but also enough of the foods rich in proteins, vitamins and minerals to ensure good health for all the people.

17. Whether it is rice or burghul, potatoes or cassava, kous kous or mealie meal, plantain or yams, staple foods are primarily a starch that supplies energy or calories and, in addition, widely varying but always inadequate amounts of the proteins for growth, and varying amounts of the vitamins and minerals needed to regulate delicate physiological mechanisms.

18. Whether diets meet human requirements for normal growth and development and the maintenance of good health depends very largely on the composition of the sauce or other accompaniment that is eaten with the staple food. The nutrients in the foods that accompany the basic dish depend in turn, to a large extent, on the horticulture practised in the country. In earlier times, green leaves, fruits and vegetables, roots and condiments were foraged in the fields and woods or grown near the house. Today, with the rapid increase of population, and the use of more and more land for cash and staple crops, wild leaves, roots and fruits can no longer be foraged in the needed amounts, nor can families who have migrated to industrialized areas grow them at home. Unaware of the causes or the results of malnutrition, families do not spend wages or the income from cash crops on foods that supplement the starchy diet. Instead, sweet biscuits, sugar, soft drinks and tea often replace the vegetables, fruits and other foods of high nutritive values.

19. Much is known about the nutrients supplied by the major basic foods. Their protein content ranges from less than 2% in cassava, yams, plantains, bananas, and sweet potatoes to 10% or more in wheat, oats, millet and sorghum. The quality of the protein from any one vegetable source is, however, inadequate for biological purposes. If the accompaniment of the starchy food contains an animal protein - meat, dried or fresh fish, milk in any form, or eggs, this high quality protein will supplement the vegetable protein.

20. Many millions of families do not use animal foods regularly because they

cannot afford them. In both Africa and Asia the production of animal protein foods cannot be increased to meet the needs of the population for many years to come. The export of a crop such as banana, may indirectly promote better nutrition of the exporting country by enabling that country to buy other foodstuffs that provide nutrients in short supply. This, however, is often not the case and it has been found in certain countries in Africa that the more land that was cultivated, the greater was the protein shortage. Two reasons are advanced for this:

(i) As the bush is cleared for cropping so bush meat is driven away, and so the farmers' reserve of first-class protein is diminished.

(ii) Instead of the new crops having a high protein content, cocoa or some other cash crop is grown that is not consumed locally. However, in every country exporting fruits, large quantities of culls that are not necessarily inferior from a nutritional point of view are usually available for consumption at very cheap rates to the local populations.

21. Post war advances in food chemistry have provided an important key to the solution of the protein problem. Knowledge of the wide variation in the distribution of amino acids in proteins from different plant sources makes it possible to combine these plant proteins to supply the amino acids essential for body growth and repair. A wide variety of pulses and peanuts grow readily in tropical areas, provide twenty to thirty-eight grams of protein per hundred grams when dried, and are good sources of the B vitamins. It is both necessary and possible to increase greatly the supplies of pulses and nuts available in tropical countries, and to promote these varieties that contain the higher levels of proteins.

Vitamins

22. The B vitamin content of the starchy staple foods varies widely. For example, undermilled and parboiled rice provide protection against beri beri because the thiamin occurring in the rice grain is conserved, whereas, in polishing, rice loses not only much of the thiamin but other nutrients as well. As a result, the poor man and his family, whose diet consists largely of polished rice, are the principal victims of beri beri while families who can afford generous portions of gram curry and other vegetables rich in thiamin with their rice, rarely suffer from beri beri.

23. In the Near East, peasants whose diets consist largely of maize tend to develop pellagra because maize is low in niacin and the protein is inferior. Those who can afford to eat pulses and other vegetables, or a skim milk cheese with their maize bread, do not develop pellagra.

24. Vitamin A is not found in starchy foods, with the exception of yellow maize and yellow sweet potatoes. Vitamic C does not occur in cereals, and only to a very limited extent in cooked roots and tubers. These vitamins must therefore come from vegetables and fruits eaten at home or in the fields or bush.

25. Green leaves, green and red peppers, orange colored fruits and vegetables and red palm oil are all excellent sources of carotene or pro-vitamin A. Green leaves also supply small amounts of high quality proteins that help to supplement the protein in starchy foods. In West Africa and other areas where red palm oil is used in sauces, and in areas where wild greens or the leaves of cassava, sweet potatoes, beets, spinach, amaranth or other plants are regular items of diet, vitamin A deficiency does not occur.

26. Eye disease resulting from vitamin A deficiency is frequently reported in North Africa, the Middle East, Northern Nigeria, many parts of India, the Philippines and areas in the Highlands of Central and East Africa where red palm oil is not available. It is possible that lack of vitamin A is second only to protein deficiency as a cause of nutritional disease, and that the two frequently occur together in children living in tropical countries.

27. Without fruits and vegetables diets are not satisfactory. For example, a school meal is normally designed to meet one-third of the child's daily nutrient allowance. In areas, where protein foods are scarce and expensive, or where fruits and vegetables are not widely used, it may be necessary for the school meal to exceed one-third rule in some nutrients in order to make up deficits in family diets. School and community gardens, and poultry raising projects make this possible at very little extra cost.

(c) IMPORTANT FRUIT SPECIES FOR THE TROPICAL AND SUB-TROPICAL AREAS

28. It may be of interest to follow in more detail a few examples of the dependence of the less developed areas of the world on fruits as important sources of essential nutrients. The prime importance of increased production and use of pulses, nuts and vegetables of all kinds has been mentioned above.

29. The mango (Mangifera indica L.) is said to occupy the largest area of any fruit crop in the tropics. India is its real commercial home, and nearly 60% of the total acreage of all fruit crops in that country is planted in mangoes. It has a tremendous local consumption there and has an important place in the nutrition of the people. The mango is an important source of vitamin A, while the vitamin C content of most common varieties is as high as or higher than in citrus fruits.

30. From the horticultural standpoint the mango has the great advantage that it is, under the right climatic conditions, a hardy tree requiring little maintenance and giving profuse yields. It is therefore a tree which is ideal in the compound or backyard as a ready source of food and shade. In many tropical countries nearly all the mangoes grown are of seedling nature, and taste, according to Fairchild, of "a ball of tow soaked in turpentine and molasses" (3). However, the "inferior" varieties are often in great demand locally for their thin sweet juice, the so-called "sucking" varieties. It is only by the propagation of known varieties by budding or grafting or by selection of seeds of polyembryonic origins that true-to-type varieties of superior and uniform quality will be obtained. When these measures are taken, not only will the local consumption be increased but the possibility of exports will be enlarged.

31. The two major fruit crops of the tropics and subtropics both in total production and amount exported are the banana and citrus. The banana (Musa spp.) as well as being the most exported of all the fruits is also the crop consumed in large amounts at home. In Uganda, for example, it has been reported that the daily consumption is 3,9lbs per head (4). This includes the starchy cooking form known as plantain. Bananas of all varieties are very low in protein content. In countries where bananas are the major staple of the diet, protein deficiencies result in high rates of infant and child mortality unless supplemented with protein rich animal foods or legumes.

(3) Fairchild, D. On the introduction of the mango into Florida, Florida Mango Forum, Mango Studies 12. (1951)

(4) Simmonds, N.W. Bananas, Longmans, London, (1959)

32. The subtropical areas of the world are by far the greatest exporters of citrus fruits, while the tropical areas produce large quantities for local and home consumption. For a variety of reasons countries with subtropical climates have been able to develop the export of citrus on a large scale - in the tropics the quality of oranges at least is usually not so high; the warm tropical climate producing a fruit low in acidity with an insipid taste, also the characteristic orange colour does not develop well unless there are somewhat lower temperatures during ripening. The behaviour of grapefruit is different - these fruits produced under tropical conditions like Nigeria or Trinidad generally develop a very fine flavour. The lime is the most prominent acid citrus crop in the tropics - and takes the place of the lemon common in the subtropics, while the mandarin also succeeds in the tropics with high rainfall conditions.

33. Citrus fruits are a rich source of vitamin C and also a good source of vitamin A. In some areas where vitamin C shortage is widespread, the deficiency is not so much a matter of economics as of education. The fruits are usually available and in cheap supply in season, but ignorance of nutrition and prejudices often associated with taboos exist against the eating of fruit. For example, in West Africa, the sweetness of a fruit is associated with effeminacy. In such cases increased production would not be followed by increased consumption unless accompanied by considerable education and propaganda.

34. Another crop in which interest has been shown by nutritionists in recent years is the guava (Psidium guajava L.) mainly because of its high vitamin C content, some strains having as much as 3 to 4 times the amount found in citrus juices. The guava is the most important species of fruit in the Myrtaceae family, and the only one of that family that is grown to any extent in plantation form. In most Central and South American countries it is not, however, grown in this matter, but large quantities of fruits are obtained from back-yard trees. It is not widely known in international trade, but in countries where it is grown the fruit and its products are an important source of vitamin C during the short guava season and in some areas in processed form. Considerable work should be done to improve the production and one of the best ways is by budding or grafting known cultivars on seedlings, as has been done to a large extent in South Africa.

35. The avocado (Persea gratissima Gaertn) is a fruit which, in order of importance, comes after citrus, bananas, pineapples and mangoes in total acreage and export of the tropical fruit crops. In its native tropical America it is an exceedingly important food crop. Unlike most fruits except the olive, its oil content ranges from 11 to 25%, both variety and 'race' determining largely the fat content, the West Indian race is the lowest, the Guatemalan intermediate and the Mexican the highest. The avocado is a good source of several vitamins, including vitamin B complex and of vitamin A and E, but low in vitamin C. It is especially valuable as a source of fat in areas where the coconut does not succeed. It is an important food for many inhabitants of Mexico and other Central American countries. In the last century, large areas of avocados have been planted outside its native tropical America - in South Africa, Australia, California, Florida, southern Spain and Chile. Because of its special qualities - as a salad fruit of high nutritive value and the fact that it stands shipment better than many other tropical fruits, the avocado seems destined to play an ever increasing part both in local consumption and as a means of increasing foreign exchange for the developing countries.

36. The Palm family (Palmaceae) has two important horticultural tree crops which play a major part in human nutrition in two very different climatic areas of the world - the coconut (Cocos nucifera L.) which grows throughout the humid tropics and the date (Phoenix dactylifera L.) which is found wild from Iran westwards to North and West Africa in arid desert-like areas. For successful fruiting and maturing of a normal crop an abundant supply of underground or irrigation water all the year round is essential. It is not generally realised that the water requirement

of date palms is higher than that of citrus, although the quality of water is of much less importance, i.e. the tree is more tolerant of salinity than most other species.

37. Dates are well known as a rich source of carbohydrates, containing as much as 70% (mainly in the form of sugars) and they also contain a moderate amount of the B-vitamins. According to Nicholls (5) "a Bedouin who takes ½ lb of dates and a pint of fermented camel's milk is making an adequate and well balanced meal of about 900 calories". In most desert areas of the world the date palm is the only crop which succeeds under extreme conditions. World production is close to 2 million tons of fruit produced from about 85 million adult date palms.

38. The most important member economically of the Palm family is probably the coconut palm, which in India is said to have 999 uses. Like most nuts its nutritional value lies primarily in its high oil and protein content. Copra, which is the main product from the coconut, is the dried white kernel which serves primarily for the manufacture of coconut oil. This oil is used as a food, i.e. in the manufacture of margarine and locally as a cooking fat. A small amount of Copra is used in the production of desiccated coconut.

39. Brief reference must be made to a large number of forest trees, shrubs and herbs which supplement the diet of both adults and children in vast areas of the tropics. These are too numerous to mention in any detail but for illustration the following species must be cited as they play an important role in human nutrition: pineapple, litchi, cashew-nut, papaya, breadfruit, annonas, passion fruit, etc.

(d) CONCLUSIONS

40. In conclusion, it is hoped that the above examples illustrate the important part which fruit and vegetable crops can play in human nutrition. In many parts of the world these foods are growing wild in the bush or forest or are raised from seedlings and planted around the compound or homestead. Others have achieved permanent plantation status and their cultivation is based on the application of modern horticultural practices. The possibilities of improvement in yield and quality of all these crops remains immense and their potentialities for providing better nutrition and better health for the ever-growing population of the world are as yet almost unrealised.

41. The same effort, skill and devotion should now be applied to the selection, breeding and cultivation of tropical and subtropical crops as have been applied to the more northern fruits and vegetables. Then their potentialities for providing scarce nutrients and delighting the palate of the world may, perhaps, be greater than those of the north.

42. The imperative need to include more fruits, vegetables, legumes and nuts in the diets of many populations of tropical regions is becoming generally recognized. Programs of education and training in nutrition combined with school and community gardening have been undertaken by the governments of more than forty countries with assistance from FAO, UNICEF and other international and bilateral agencies. The production, preparation and preservation of fruits and vegetables is being taught in many countries through programs of home economics extension and community development. The cooperation of horticulturists with special skills in teaching and demonstrating, and a knowledge of tropical and subtropical fruit and vegetable production is essential to the successful expansion of these programs throughout the developing countries.

(5) Nicholls, L., Sinclair, H.M. and Jeliffe, D.B. "Tropical Nutrition and Dietetics" Baillière, Tindall and Cox, London (1961)

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